DETAILED ACTION

Information Disclosure Statement

The examiner notes that the reference lined through as not having been considered on the IDS filed September 15, 2006 was not considered because the reference was improperly cited. Due to the pertinence of said reference to the instant claims, the reference has been cited by the examiner in the corresponding Notice of References Cited.

Claim Objections

Claim 76 is objected to because of the following informalities: in line 2, the word "scatting" should be changed to read "scattering" so as to be properly spelled. Appropriate correction is required.

Claim 77 is objected to because of the following informalities: in line 4, the claim recites "whereby a real of complex refractive index of said lubricant may be determined". The portion "a real of complex" is grammatically confusing; the examiner is not sure whether the phrase should be "a real complex refractive index" or something else entirely. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 53-57, 60-64, and 77-78 are rejected under 35 U.S.C. 102(b) as being anticipated by Stevenson (5,239,176).

Regarding claim 53, Stevenson (Figs. 1-3) discloses an apparatus for optically determining the condition of a fluid, the apparatus comprising a light source 54 to provide light for interacting with said fluid, the fluid being contained within housing 40; a detector 62 for detecting a level of light from said light source; an optical path 16, 18 between said light source and said detector, said optical path including a reflection from an evanescent wave interface 20; and wherein said apparatus is configured such that said fluid may be brought sufficiently close to said interface (sensor 20 is mounted in the housing 40, see Col. 4, lines 22-32) for an evanescent wave formed by total internal reflection (see Fig. 1) of light at said interface to interact with said fluid; whereby a condition (such as absorbance, see Fig. 3) of said fluid is determinable from said detected light level. The examiner notes that it has been held that the functional "whereby" statement does not define any structure and accordingly cannot serve to distinguish. *In re Mason*, 114 USPQ 127, 44 CCPA 937 (1957).

As for claim 54, as shown in Figure 1, Stevenson discloses a substantially totally internally reflecting interface at evanescent wave interface 20.

As for claim 55, in Figure 4, Stevenson discloses mirror 92.

As for claim 56, Stevenson discloses fiber optic 10, with the interface 20 being a tapered region of the fiber optic.

As for claim 57, Stevenson discloses cladding layer 14 as a protective housing for the fiber.

As for claims 60-61, the interaction between the evanescent wave and the fluid comprises both absorption of light by the fluid (see Fig. 3) and coupling or propagation of light into the fluid (inherent to how an evanescent sensor operates).

As for claim 62, Stevenson discloses signal processor 66.

As for claim 63, Stevenson discloses the ability to detect a degradation in the condition of the fluid, as Stevenson discloses absorbance numbers for a variety of concentrations of acetone in the fluid (see Col. 4, lines 33-64 as an example)

As for claim 64, Stevenson discloses absorbance values at a variety of wave numbers, indicating that the device is able to provide and detect light of at least two different wavelengths.

Regarding claim 77, Stevenson (Figs. 1 and 2) discloses a sensing apparatus comprising an illumination source 54 to source illumination at an operating wavelength of the apparatus and a tapered fiber optic 20 configured to couple light at said operating wavelength out of said taper and into said lubricant contained in housing 40, whereby a real complex refractive index of said lubricant may be determined. The examiner notes that it has been held that the functional "whereby" statement does not define any structure and accordingly cannot serve to distinguish. *In re Mason*, 114 USPQ 127, 44 CCPA 937 (1957).

Regarding claim 78, Stevenson (Figs. 1 and 2) discloses an optical sensor module comprising an evanescent wave sensor 20; module housing 40 for said sensor; and an optical connector 10 for connecting said sensor to said evanescent field sensing apparatus. With regards to the limitation in the preamble regarding optically determining the condition of oil, the recitation has not been given patentable weight because it has been held that a preamble is denied the effect of a limitation where the claim is drawn to a structure and the portion of the claim following that preamble is a self-contained description of the structure not depending for completeness upon the introductory clause. *Kropa v. Robie*, 88 USPQ 478 (CCPA 1951).

Claims 74-75 are rejected under 35 U.S.C. 102(b) as being anticipated by Hale (GB 2,212,261).

Regarding claim 74, Hale discloses a method of determining a degree of degradation of a lubricant, the method comprising measuring a level of particulate scattering (scattered light is picked up by optical filters 17) by the lubricant (oil in water – see abstract); and determining said degree of degradation of the lubricant from said level of particulate scattering (see, for example, claim 1 of Hale).

As for claim 75, as Hale is measuring oil in water, it follows that the Hale measurement is responsive to a complex refractive index value of the oil, as the measurement will be affected from the amount of oil that the light in the cavity traverses prior to being detected versus the amount of water that the light in the cavity traverses.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 41-52, 58, and 67-73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stevenson (5,239,176) in view of Luukkala et al (4,882,499).

Regarding claim 41, Stevenson (Figs. 1 and 2) discloses a sensor module comprising an evanescent wave sensor 20; a fluid permeable module 40 housing for the sensor; and an optical connector 10 for connecting the sensor to an attenuated total internal reflection apparatus.

Stevenson, however, fails to disclose the sensor sensing oil.

Luukkala, in a fiber optic detection system (Fig. 1), discloses a detector that features a pick-up 14 at the end of a fiber 13 that, when placed into liquid 16, can detect the presence of oil.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the device of Stevenson to detect the presence of oil in a liquid as per Luukkala, the motivation being that Luukkala explicitly discloses the desirability of using a fiber optic sensor to detect oils.

As for claim 42, Stevenson discloses that the evanescent wave sensor 20 is part of an optical fiber 10 that allows interaction of an evanescent wave of light guided within the fiber with the fluid being measured.

As for claim 43, Stevenson discloses tapered portion 20 defining the evanescent wave sensor.

As for claim 44, the optical connector 10 comprises a portion of the optical fiber of the evanescent wave sensor.

As for claims 45-46, Stevenson (Fig. 4) discloses a mirror 92 as a reflector at a sensor end and/or at a connector end of the optical fiber.

As for claim 47, the combined device of Stevenson and Luukkala discloses the claimed invention as set forth above regarding claim 46, but fails to disclose the mirror being a coating on the end of an optical fiber. The combined device, via Stevenson, already discloses a mirror 92 at the end of the optical fiber. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to substitute the bulk mirror of the combined device for a mirror that takes the form of a coating at the end of the fiber, since the examiner takes Official Notice as to the functional equivalence of the bulk mirror and a mirror that is a coating

at the end of the fiber for their use in fiber optic sensing, with the selection of one mirror in place of another being within the level of ordinary skill in the art. This substitution has the added benefit of making the device more compact.

As for claim 48, as Stevenson discloses the ability of measuring the amount of a substance within the liquid based on the absorbance of light by that substance (see Col. 4, lines 33-64 as an example), it follows that the combined device can determine the degradation of oil in the same manner.

As for claim 49, the combined device of Stevenson and Luukkala discloses the claimed invention as set forth above regarding claim 48, but fails to disclose the use of ferrules and spacers to attach the fiber to the module housing. However, Official Notice is taken as to the well known use of ferrules and spacers to attach optical fibers to a variety of objects; therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use ferrules and spacers to attach the optical fibers of the combined device to the housing, the motivation being that ferrules and spacers are notoriously well known for their effective, predictable use in providing secure attachment of optical fibers to other objects.

As for claim 50, the combined device of Stevenson and Luukkala discloses the claimed invention as set forth above regarding claim 41, but fails to disclose the housing being made out of ceramic. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to make the housing out of ceramic, sine it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As for claim 51, Luukkala discloses a dipstick, as pick-up 14 is dipped into solution 16 for measurement.

As for claim 52, as Stevenson and Luukkala disclose the sensor module of claim 41, Stevenson and Luukkala disclose an apparatus for optically determining the condition of oil using ATIR.

As for claim 58, Stevenson discloses the claimed invention as set forth above regarding claim 55, but fails to disclose a dipstick for sampling the fluid, the dipstick containing the fiber optic.

Luukkala, in a fiber optic sensor, discloses a dipstick, as pick-up 14 attached to optical fiber 13 is dipped into solution 16 for measurement.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the sensor of Stevenson into a dipstick as per Luukkala, the motivation being that Luukkala explicitly discloses the viability of a dipstick style fiber optic sensor for fluid sensing.

Regarding claim 67, Stevenson discloses a method comprising measuring using the device of Figures 1 and 2 via light detected at detector 62 and processed by processor 66 an attenuation of an internal reflection at an interface 20 due to an interaction of light with a fluid in housing 40 mediated by an evanescent wave formed at said interface; and determining a condition of the fluid (such as concentration as measured by absorbance, see Fig. 3) from said attenuation.

Stevenson, however, fails to disclose the measurement of oil.

Luukkala, in a fiber optic detection system (Fig. 1), discloses a detector that features a pick-up 14 at the end of a fiber 13 that, when placed into liquid 16, can detect the presence, and thereby a condition, of oil.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the device of Stevenson to detect the presence, and thereby a condition, of oil in a liquid as per Luukkala, the motivation being that Luukkala explicitly discloses the desirability of using a fiber optic sensor to detect oils.

As for claim 68, the combined device sets forth the claimed invention as disclosed above regarding claim 67, but fails to disclose that the oil has an absorbance of greater than unity at a wavelength of light. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to chose a wavelength of light to have an absorbance with the oil being greater than unity, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

As for claim 69, as set forth by Luukkala, one can lower the pick-up 14 deeper into the solution 16 to adjust a degree of interaction between the sensor and the oil. As a result of the combination of Stevenson and Luukkala, this would also comprise adjusting an extension of the evanescent wave from the interface into the liquid.

As for claim 70, Stevenson discloses the absorption of light as a measure of interaction of light with the solution being measured in the liquid.

As for claim 71, as Stevenson discloses an evanescent measurement, the coupling of light to the fluid being measured is concurrently disclosed.

As for claim 72, as Stevenson discloses the ability of measuring the amount of a substance within the liquid based on the absorbance of light by that substance at a variety of wavelengths (see Col. 4, lines 33-64 and Fig. 3 as an example), it follows that the combined device can determine the degradation of oil in the same manner.

As for claim 73, the combined device discloses the claimed invention as set forth above regarding claim 72, but fails to disclose distinguishing between attenuation caused by a change in temperature from attenuation caused by a change in scatter.

As is known to one having ordinary skill in the art, the measurement of properties of a fluid is sensitively dependent on the temperature of that fluid. Furthermore, it is common to perform measurements as multiple wavelengths. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use multiple wavelengths to distinguish a change in scattering from a temperature change, the motivation being that, when faced with the problem of accounting for error due to temperature change, the skilled artisan would repeat the measurement in order to obtain a more accurate result.

Claims 65-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stevenson (5,239,176) in view of Hale (GB 2,212,261).

As for claim 65, Stevenson discloses the invention as set forth above regarding claim 55, but fails to disclose the measurement of scatter by the fluid.

Hale discloses an apparatus of determining a degree of degradation of a lubricant, the apparatus comprising measuring a level of particulate scattering (scattered light is picked up by optical filters 17) by the lubricant (oil in water – see abstract).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to measure scatter with the device of Stevenson as per Hale, the motivation being that Hale explicitly discloses the measurement of scatter from matter in a fluid via a fiber optic sensor.

As for claim 66, the combined device discloses the claimed invention as set forth above regarding claim 65, but fails to disclose using two wavelengths to compare detected light levels in order to distinguish a change in detected light level caused by temperature from a change caused by a change in light scatter.

As is known to one having ordinary skill in the art, the measurement of properties of a fluid is sensitively dependent on the temperature of that fluid. Furthermore, it is common to perform measurements as multiple wavelengths. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use multiple wavelengths to distinguish a change in scattering from a temperature change, the motivation being that, when faced with the problem of accounting for error due to temperature change, the skilled artisan would repeat the measurement in order to obtain a more accurate result.

Claim 76 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hale (GB 2,212,261).

As for claim 76, Hale discloses the claimed invention as set forth above regarding claim 74, but fails to disclose measuring a level of particulate scattering using two or more wavelengths or colors to distinguish a change in particulate scattering from a temperature change.

As is known to one having ordinary skill in the art, the measurement of properties of a fluid is sensitively dependent on the temperature of that fluid. Furthermore, it is common to perform measurements as multiple wavelengths. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use multiple wavelengths to distinguish a change in scattering from a temperature change, the motivation being that, when faced with the problem of accounting for error due to temperature change, the skilled artisan would repeat the measurement in order to obtain a more accurate result.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Pat. 4,159,420 to Tsunoda; US Pat. 5,483,346 to Butzer; US Pat. 6,356,675 to Weiss; US Pat. 7,046,362 to Lehmann et al.; and US 2002/0122179 to Pipino.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael A. Lyons whose telephone number is (571)272-2420. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley can be reached on 571-272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Michael A Lyons/
Primary Examiner, Art Unit 2877
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